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The expansion of the lunar crustal field caused by a solar wind current sheet

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We report a sudden expansion of the lunar crustal field observed by ARTEMIS P1 at an altitude of 1035 km near the optical shadow boundary of the Moon. The lunar crustal field is located at 81˚E and 8˚N on the lunar surface and is characterized by strong depletions of ion and electron fluxes indicative of closed magnetic field lines. Such expansion of crustal field is found to be the combination of the crustal field, the interplanetary magnetic field and the induced magnetic field of a solar wind current sheet. Our analysis show that the current sheet is a rotational discontinuity with nonzero normal magnetic fields. The calculated $J \cdot E < 0$ indicates that the current sheet is a small-scale dynamo. The poynting flux of this dynamo, which transfers other energies into electromagnetic energy, can provide electromagnetic energy that is required to support the expansion of the lunar crustal field in this study.